



The Case for Fire Sprinklers in One- and Two-Family Dwellings

**National Fire Protection Association
Fire Sprinkler Initiative**

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[This document provides testimony on the importance of home fire sprinklers and the cost and effectiveness of these systems in one- and two-family homes.]

THE CASE FOR HOME FIRE SPRINKLERS

The mission of the international nonprofit NFPA, established in 1896, is to reduce the worldwide burden of fire and other hazards on the quality of life by providing and advocating consensus codes and standards, research, training, and education. This document provides testimony on the importance of home fire sprinklers and the cost and effectiveness of these systems in one- and two-family homes.

The U.S. Fire Problem

Fire in the home poses one of the biggest threats to the people of your community. U.S. fire departments responded to an average of 371,700 home structure fires per year during the five-year period of 2006-2010. About 350,000 of the fires occurred in homes without automatic extinguishing equipment. These fires caused an estimated average of 2,600 civilian deaths, 12,900 civilian injuries, \$7.2 billion in direct property damage, and 25,600 firefighter injuries at the fireground per year.

Those at greatest risk are:

- Older adults – over age 65
- Children – under 5 years old
- Persons with disabilities

These high risk groups may not be able to exit on their own, even with working smoke alarms. They may need the additional escape time provided by home fire sprinkler systems. NFPA 13D systems are designed to provide a ten minute escape time.

Fire Sprinklers Reduce Civilian Fire death and Costs

- Sprinklers reduce civilian fire deaths by **83%**.
- civilian fire death cost reduction of **\$10.4 billion** per year

A fatal home fire impacts the entire community. It begins with grieving survivors, having to mourn the loss of loved ones. Burn injury survivors require lifelong support to recover from them, as found on the website of the [Phoenix Society for Burn Survivors](#). According to the [Burn Survivor Resource Center](#); “burns are one of the most expensive catastrophic injuries to treat. For example, a burn of 30% of total body area can cost as much as \$200,000 in initial hospitalization costs and for physicians’ fees. For extensive burns, there are additional significant costs which will include costs for repeat admission for reconstruction and for rehabilitation.” Homes sustaining extensive fire damage will have to be demolished and will remain off the tax rolls for some time, impacting community revenue. The long term effects of home fire burn injuries and the impact of home fires on the community must be included in the home fire sprinkler debate.

Fire Sprinklers Reduce Injury Cost

While there has long been data correlating sprinklers with reductions in deaths and property loss, recent research also shows a significant impact on injury cost when sprinklers are present.

- Sprinklers reduce civilian fire injury **medical costs by 53%**,
- Sprinklers reduce civilian fire injury **total costs by 41%**.
- Sprinklers are responsible for an estimated **65% reduction in firefighter fireground injuries**.

Fire Sprinklers Reduce the Cost of Loss

If all homes had been sprinklered when the fire occurred it would have resulted in:

- civilian fire injury medical costs reduction of **\$0.2 billion** per year
- civilian fire injury total cost reduction of **\$0.7 billion** per year

THE NATIONAL CONSENSUS IS IN FAVOR OF HOME FIRE SPRINKLERS

All model safety codes now require the use of home fire sprinklers in new one- and two-family homes. This occurred through a process properly vetted by both private and public concerns and not influenced by any single special interest group. These are minimum standards of safety to protect the people in their homes. NFPA is against any proposal that removes this requirement from the code, thus reducing the established minimum standards of life safety in one- and two-family homes. Amending the requirement out of the code equates substandard housing.

The matter of choice

Building, fire, and life safety codes must always be guided by minimum codes and policy decisions and are not a matter of consumer choice. These safety standards are always included in the fixed costs of homes, cars, etc. Only the original buyers of “custom homes” will be able to make the choice. Buyers of “spec” homes and existing homes will be deprived of the ability to make that choice. Requiring home fire sprinklers protects the housing stock for the next 75-100 years

SMOKE ALARMS AND SPRINKLERS BOTH SAVE LIVES FROM FIRE

Home fire sprinklers are a proven way to protect lives and property against fires at home. These life-safety systems respond quickly and effectively to the presence of a nearby fire. When sprinklers are present, they save lives. Sprinkler systems provide additional benefits, on top of the benefits already provided by smoke alarms.

- Working smoke alarms cut the risk of dying in a home fire by 50 percent.
- If you have a reported fire in your home, the risk of dying decreases by about 80 percent when sprinklers are present.

Percentages of survival and death

You will hear sprinkler opponents using a statistic of 99.4% to illustrate the effectiveness of smoke alarms in reducing home fire deaths. This NFPA statistic is based on the total number of fires, the vast majority of which are not fatal. Does that mean 2,500 deaths every year are acceptable? Most people would say no. It is similar to saying that because the survivability of motor vehicle crashes is also around 99.4%, that we should not look for ways to improve highway safety. Smoke alarms and fire sprinklers provide the required level of fire safety in the home, just as seat belts and airbags do so in cars.

SPRINKLERS DO MORE THAN SAVE LIVES

Home fire sprinklers protect property

“Saving lives” means more than just preventing deaths. Just as there is no other fire safety technology or programs that produce as great a reduction in risk of death as sprinklers, there also is no other fire safety technology or program that produces as great a reduction in property loss per fire as sprinklers.

- Sprinklers reduce direct property damage per fire by **69%**.
- Sprinklers reduce direct property damage by **\$4.8 billion** per year

Home fire sprinklers are good for the environment

The findings of a groundbreaking study, made possible through a collaborative effort of [FM Global](#) and the [Home Fire Sprinkler Coalition](#), titled [The Environmental Impact of Automatic Fire Sprinklers](#), released in March 2010 found that fire sprinklers:

- Reduce greenhouse gases by **98%**
- Reduce fire damage by up to **97%**
- Reduce water usage to fight a home fire by upwards of **90%**

- Reduce the amount of water pollution released into the environment
- Reduce debris to landfills

EFFECTIVENESS AND RELIABILITY OF FIRE SPRINKLERS

Home sprinkler systems respond quickly to reduce the heat, flames, and smoke from a fire, giving families valuable time to get to safety.

It is important to recognize that home fire sprinkler systems are designed to activate to the heat of a fire that grows large enough for the temperature to reach 135°-160°F. They are not activated by smoke, nor should they be.

In home fires deemed large enough to activate an operational sprinkler, in 2006-2010, sprinklers were effective in 96% of the cases.

- When wet-pipe sprinklers operated, 88% of reported fires involved only 1 or 2 sprinklers.
- Each individual sprinkler is designed and calibrated to go off with a significant heat change.
- Only the sprinkler closest to the fire will activate, spraying water directly on the fire.

INSPECTION AND MAINTENANCE

The installer must provide the owner/occupant instructions on inspecting, testing, and maintaining the system. NFPA 13D systems do not require the use of professional inspection services. The sprinkler system must be inspected and tested by the homeowner periodically to ensure it is in good working order. The system must be maintained in good working order in accordance with the standard and following manufacturer's instructions.

NFPA 13D mandates additional testing and maintenance of antifreeze systems. Samples of antifreeze solution must be collected by qualified individuals on an annual basis to verify that the solution is in compliance with concentration requirements, and that the solution provides the appropriate antifreeze protection.

NFPA 13D multipurpose piping systems do not require testable backflow preventers. When backflow preventers are required by the jurisdiction, a yearly inspection performed by a professional is necessary.

NEWER HOMES AND FIRE

Opponents of residential fire sprinkler systems like to boast that newer homes are safer homes and that the fire and death problem is limited to older homes. Age of housing is a poor predictor of fire death rates. When older housing is associated with higher rates, it usually is because older housing tends to have a disproportionate share of poorer, less educated households. Statistically, the only fire safety issue that is relevant to the age of the home is outdated electrical wiring. Beyond that, age of the home has little to nothing to do with fire safety.

In fact, new methods of construction negatively impact occupant and firefighter life safety under fire conditions. The National Research Council of Canada (NRC) tested the performance of unprotected floor assemblies exposed to fire. The findings of the study, [*The Performance of Unprotected Floor Assemblies in Basement Fire Scenarios*](#) assert that these structures are prone to catastrophic collapse as early as six minutes from the onset of fire.

In 2008, Underwriters Laboratories® (UL) conducted a study to identify the danger to firefighters created by the use of lightweight wood trusses and engineered lumber in residential roof and floor designs. The findings of the report, [*Structural Stability of Engineered Lumber in Fire Conditions*](#), point to the failure of lightweight engineered wood systems when exposed to fire. Firefighters expecting

thirty minutes of structural integrity with dimensional wood structures face higher peril in lightweight structures.

The same UL study found that the synthetic construction of today's home furnishings add to the increased risk by providing a greater fuel load. Larger homes, open spaces, increased fuel loads, void spaces, and changing building materials contribute to:

- Faster fire propagation
- Shorter time to flashover
- Rapid changes in fire dynamics
- Shorter escape time
- Shorter time to collapse

In May, 2011 the NRC released [Research Report IRC-RR-307 Performance of Protected Ceiling/Floor Assemblies and Impact on Tenability with A Basement Fire Scenario](#) [Phase II (PII)]. In addition to testing the structural integrity of engineered wood assemblies under fire conditions, both phases of the study also tested smoke alarm performance, fire development, sequence of events, and tenability, in relation to evacuation of occupants.

The results of the NRC research projects are considered critically important due to the perceived notion by numerous stakeholders (including some in the fire service) that protection of engineered floor assemblies constitutes equivalency to fire sprinklers.

Protection of engineered floor assemblies is included in the 2012 IRC. This requirement in the model code is in addition to the requirement of fire sprinkler installation in the dwelling. There are very good reasons for this; protection of engineered floor assemblies, while extending the time to structural instability and collapse under fire conditions, does nothing to prevent the fire from growing or to become deadly for occupants and responding fire crews; as supported by this NRC report

Although passive protection of solid-sawn wood joists, wood I-joists, steel c-joists, metal web trusses with gypsum board increases structural stability for longer time periods, the structures always failed and collapsed after a certain time during the experiments. The same applies to suspended ceilings. Most importantly, the structural failure of the test assembly occurred well after the untenable conditions were reached.

The test assemblies protected by residential fire sprinklers did not fail or collapse. Conditions that would cause incapacitation did not exist, or were quickly reversed by sprinkler activation. Tenable conditions remained throughout the structure.

Passive protection of engineered wood assemblies by gypsum and suspended ceilings will do little to increase life safety in the event of fire in the home, especially for susceptible (high risk) persons. These high risk groups; young children, adults older than 65 and disabled persons are disproportionately incapacitated earlier in fire events by FED values reached when structures are not protected by fire sprinklers. Fire sprinklers can offset the increased dangers posed by lightweight construction and create a safer fire environment for occupants and firefighters to operate in.

THE COST OF NFPA 13D SPRINKLER SYSTEMS

The Fire Protection Research Foundations' [Home Fire Sprinkler Cost Assessment- 2013](#) report revealed that the cost of installing home fire sprinklers averages \$1.35 per square sprinklered foot (SF) for new construction. The data included in the report also reflects the sprinkler system bid price plus all associated costs for the system which were not included in the bid, such as; permit fees, increase in water service line, and increase in tap fee.

To put the cost of a sprinkler system into perspective, many people pay similar amounts for carpet upgrades, granite countertops, paving a stone driveway, or a whirlpool bath.

INCENTIVES TO OFFSET COSTS

Most recently, the Fire Protection Research Foundation released the [*Incentives for the Use of Residential Fire Sprinkler Systems in U.S. Communities*](#) report revealing that typical incentives offered by communities may offset up to one-third of the cost of home fire sprinkler systems.

HOUSING COST AND SUPPLY IMPACT

In a recently released study, [*Comparative Analysis of Housing Cost and Supply Impacts of Sprinkler Ordinances at the Community Level*](#), conducted by Newport Partners for NFPA, it is reported that: **“...analysis did not reveal that the enactment of sprinkler ordinances caused any detrimental effects on housing supply and costs.”** The report clearly indicates there is no merit to the claim that a residential sprinkler requirement creates an unfair market advantage for an area that does not have a requirement, as claimed by sprinkler opponents.

INTEGRATION OF RESIDENTIAL SPRINKLERS WITH WATER SUPPLY SYSTEMS

NFPA 13D requires only the standard operating water pressure of the domestic plumbing system. Most domestic water supply systems are able to manage the operating pressure demands of a home fire sprinkler system.

The [*Integration of Residential Sprinklers with Water Supply Systems*](#) study conducted by Newport Partners for NFPA addressed the requirement of local water purveyors and building departments in twenty communities, and its impact on system design, operation, cost, and maintenance.

Key findings of the study follow:

- Majority did not experience water meter cost increase
- 90% experienced no increase in service fees
- Domestic water consumption rates did not increase
- Majority did not see an increase in tapping fees

The study concluded that communities integrating residential fire sprinklers with water supply systems employ practical solutions that satisfy the needs of builders, water purveyors, and the fire service.

On site water supply

Well systems can be set up to effectively address a fire protection application. Generally speaking, they are set up at the inception of the home building process and a larger well pump is usually installed along with larger expansion tanks. Homes on well water most likely will need a pump to serve the domestic water supply. The cost associated with providing additional pressure to run the fire sprinkler system may simply be the difference between the regular pump the homeowner must install to obtain the necessary pressure for domestic use, and a higher flow pump, or a booster pump and tank. The expansion tanks are sized to pick up the difference between the well capacity and demand so they are not necessarily large. To meet the requirements of NFPA 13D, many installations have been done using this method, effectively and cost competitively.

WATER CONSERVATION

A recent study, [*Residential Fire Sprinklers – Water Usage and Water Meter Performance*](#), evaluated total water usage during sprinkler activation at a fire scene (fire flow) in comparison to water usage by the fire service performing extinguishment operations in non-sprinklered homes. The study revealed that, assuming ten minutes of operation, a home fire sprinkler system could discharge up to 280 gallons of water per fire. By comparison, the average water discharged at a home fire without

a fire sprinkler system averaged 2,935 gallons. Water infrastructure demand is reduced at least 47% when the homes within a community are protected by fire sprinkler systems

This study also evaluated water meter performance during typical sprinkler actuation. All water meters exhibited metering accuracy within the industry standards at flow conditions up to approximately 150% of their normal operating range. The pressure loss profiles from these meters was less than or similar to the generic NFPA 13D suggested values at the respective flow rates.

HOMEOWNER INSURANCE ISSUES

ISO Fact Sheet

ISO, an independent statistical, rating, and advisory organization that serves the property/casualty insurance industry and the leading supplier of underwriting information, advisory loss costs, supplementary rating information, and standardized policy information language to insurers in all fifty states and the District of Columbia offers the following advisory on its [ISO Fact Sheet](#):

Premium discounts

The ISO provides premium credits for installation of fire sprinkler protection up to a maximum of:

- 13% for full sprinkler protection that includes all areas of a home, including attics, bathrooms, closets, and attached structures;
- 8% for fire sprinkler protection of all areas of a home excluding the attic, bathrooms, closets, and attached structures as long as fire detection equipment is installed in those areas where sprinklers are omitted;

Individual insurer programs may provide different credits. The cost assessment report found insurance discounts ranging from 0% to 12%, with an average of 7%.

Sprinkler leakage coverage

The presence of a residential sprinkler system may raise concern about the risk of accidental water leakage from the system. ISO's standard Homeowners policy forms provide coverage for "...accidental discharge or overflow of water...from within a...fire protective sprinkler system...". This coverage is included in the basic policy. There is no extra charge for this coverage. Also, coverage is provided for water damage related to the suppression or extinguishment of a covered fire. Individual insurer programs may provide variations to this coverage.

Building Code Effectiveness Grading Schedule (BCGES®)

The ISO Building Code Effectiveness Grading Schedule (BCGES®) is used to review public building code enforcement agencies and to develop a classification that is provided as advisory information to insurers who may use it for insurance underwriting and rating.

POSSIBLE IMPACT OF AMMENDING THE SPRINKLER REQUIREMENT FROM THE CODE

If the requirement for automatic fire sprinkler protection of residential dwellings was removed by legislation or local ordinance, BCEGS would not provide full recognition for adoption of code without amendments. ***A building code enforcement agency that adopted a code with amendments that weaken hazard mitigation issues, as defined in the model codes and referenced standards, would not receive maximum recognition for code adoption.*** This statement is vitally important to the debate over one- in two family dwelling fire sprinklers.

The National Flood Insurance Program's (NFIP) [Community Rating System \(CRS\)](#) is a voluntary incentive program that recognizes and encourages community floodplain management activities that exceed the minimum NFIP requirements. FEMA and the insurance industry look for uniformity in code adoption because the code development process takes into account the total effect of all

relevant factors. Amendments to the code affect the structural integrity of the entire code document. In this case, the penalty can have devastating effects.

The table below shows the credit points earned, classification awarded, and premium reductions

Credit Points	Class	Premium Reduction
4,500+	1	45%
4,000 – 4,499	2	40%
3,500 – 3,999	3	35%
3,000 – 3,499	4	30%
2,500 – 2,999	5	25%
2,000 – 2,499	6	20%
1,500 – 1,999	7	15%
1,000 – 1,499	8	10%
500 – 999	9	5%
0 – 499	10	0

given for communities in the NFIP CRS. As you will note, every change in Community Classification results in a 5% change in flood insurance premium.

The following is from the FEMA/NFIP classification system manual:

b. Class 7 Prerequisite:

*In addition to having sufficient points, in order to be a Class 7 or better, a community must have received a classification of 6/6 or better under the Building Code Effectiveness Grading Schedule (BCEGS). **Both BCEGS classifications (residential/personal and commercial) must be a class 6 or better** (emphasis added).*

c. Class 4 Prerequisite: In order to be a Class 4 or better, a community MUST:

- *Have received a classification of 5/5 or better under the BCEGS*

The BCEGS penalty, although small (about 4%), can mean the difference between one class and the next-better class. [The CRS Eligible Communities](#) table contains the rating of each of the eligible communities. The economic impact on communities with a five or six rating is greater, should their rating class change. The communities, the fire departments, and the insurance-buying homeowners all have potentially millions of dollars riding on this decision.

HOME FIRE SPRINKLER REQUIREMENTS – IMPACT ON FIRE SERVICE

Requiring fire sprinklers in new homes helps fire service efforts. Adopting home fire sprinkler requirements have allowed the fire service to keep up with growth, and to continue to provide an appropriate level of service, which many times translate into savings for a community.

CONCLUSION

Extensive research has revealed that fire sprinklers save lives, protect property, and benefit the environment. Home fire sprinklers can also offset the increased dangers posed by homes built with lightweight construction and create a safer fire environment for occupants and firefighters.